(12) UK Patent Application (19) GB (11) 2 336 183 (13) A

(43) Date of A Publication 13.10.1999

(21) Application No 9725108.6

(22) Date of Filing 28.11.1997

(51) INT CL[6]
F04F 7/02

(52) UK CL (Edition Q)
F1R R6

(56) Documents Cited
GB 0391289 A GB 0276485 A WO 97/37136 A1
US 4537563 A

(58) Field of Search
UK CL (Edition Q) F1R R6
INT CL[6] F04F 7/00 7/02
Online: WPI, EPODOC

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(54) Abstract Title
Adjustable hydraulic ram pump.

(57) A hydraulic ram pump comprises a body 11 defining an internal inlet chamber 40, a valve seating 26. A resilient valve member 28 within the body separates inlet chamber and an outlet chamber 41. The valve member is displaced into engagement with the valve seat by flow from the inlet to the outlet thereby stopping said flow. The resulting pressure pulse forces water through delivery port 21. Threaded rod 30 provides adjustment for the relative positions of the valve member and the seat through rotation of knob 36. Adjustment permits optimisation for different installations and use of replacement valve members of different stiffness from the original. The body 11 has one end closed by a removable plate 14 or comprises two halves joined at a flange (250,251 Figs. 3,4) for easy valve replacement. Alternatively, the valve seat position may be adjusted relative to the body (Fig. 4).

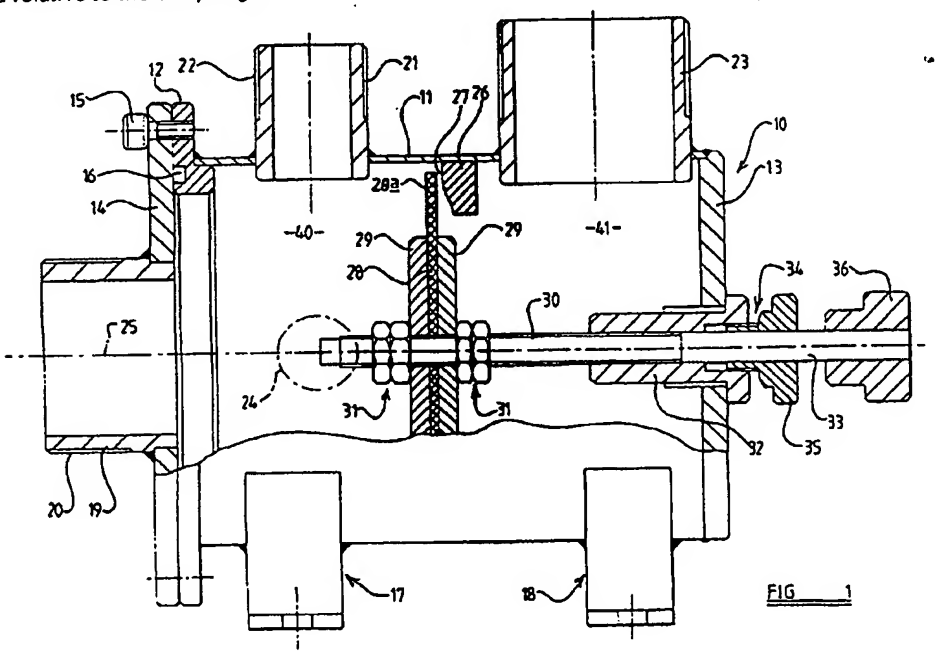

FIG 1

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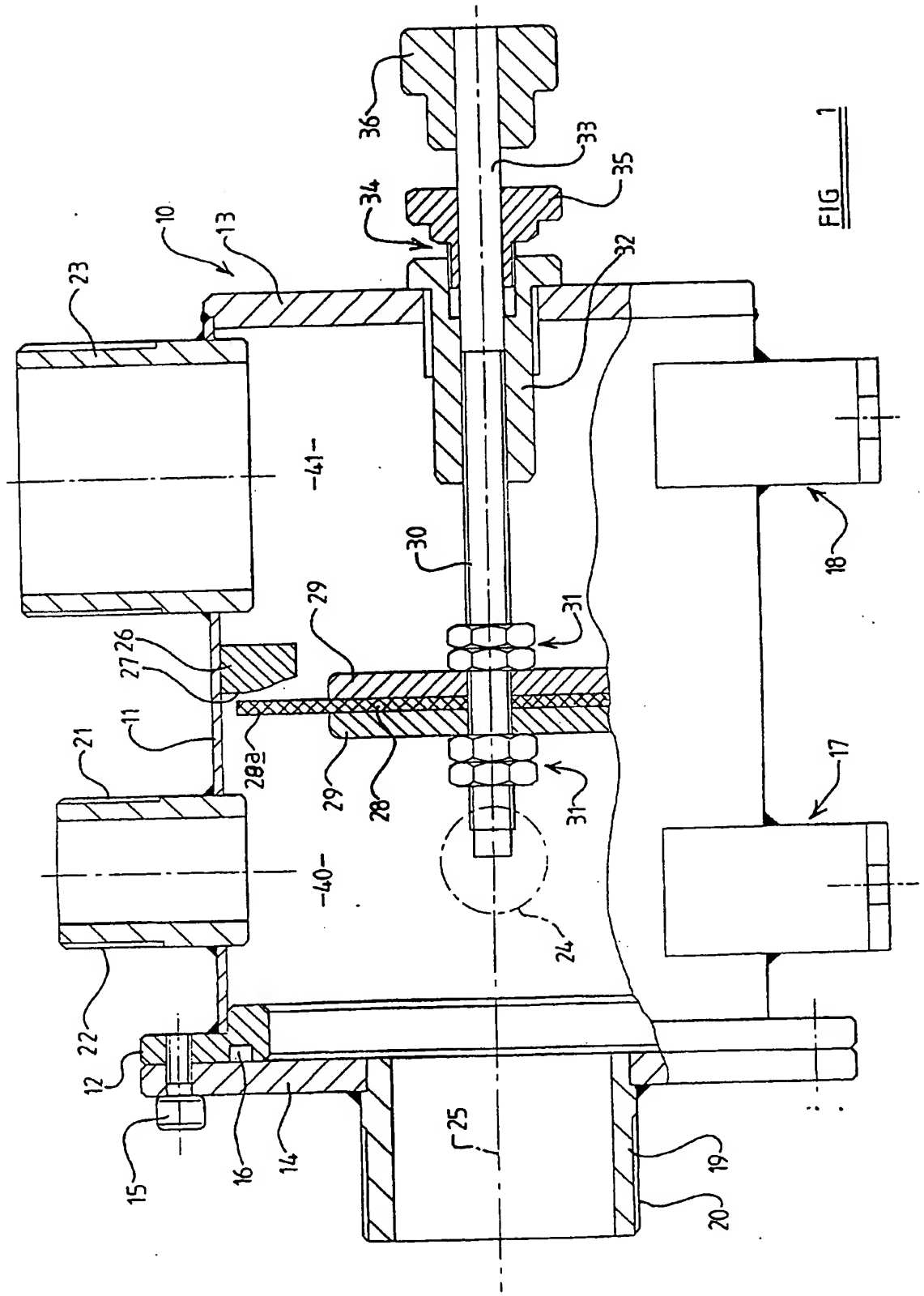
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FIG 1

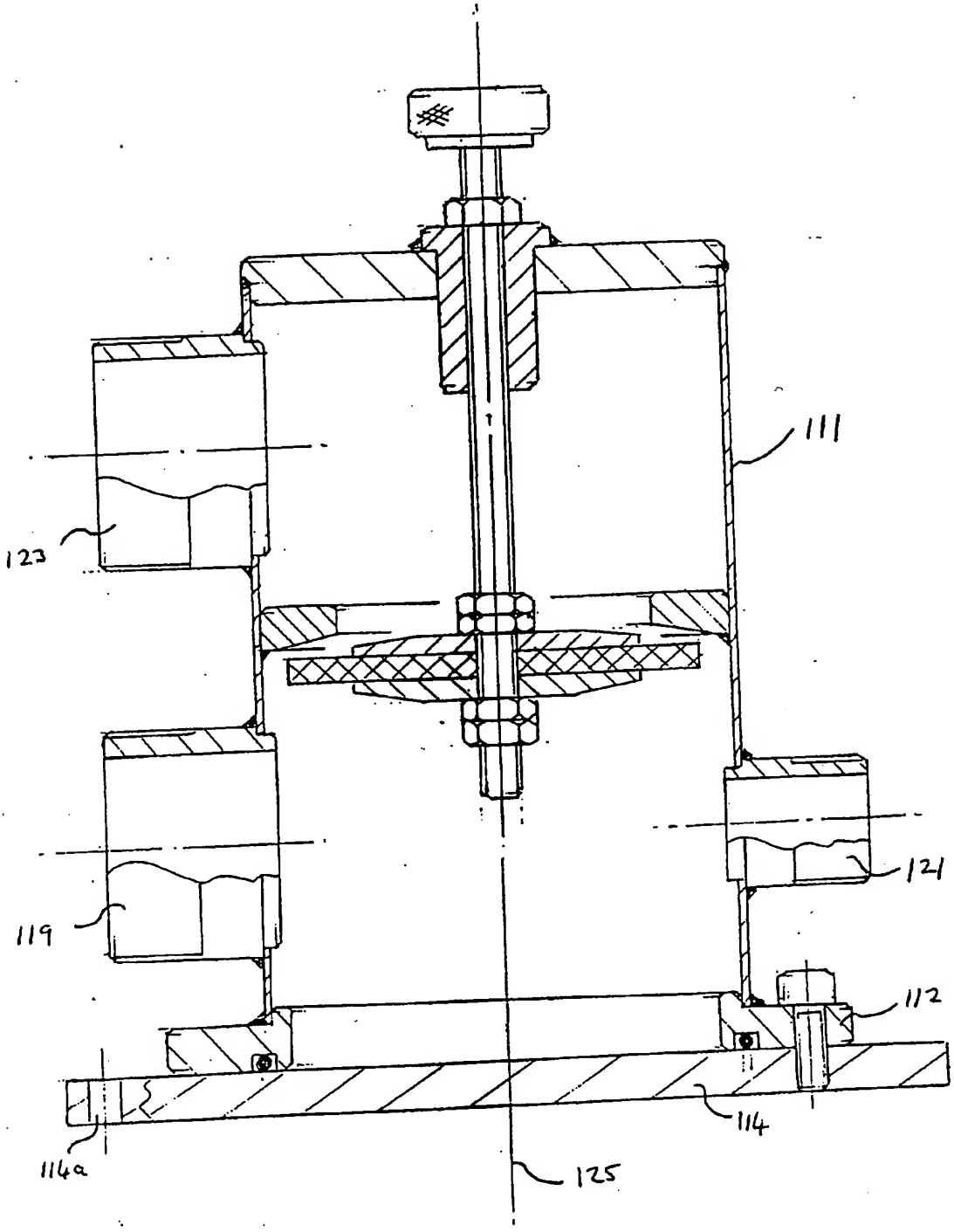

FIG 2

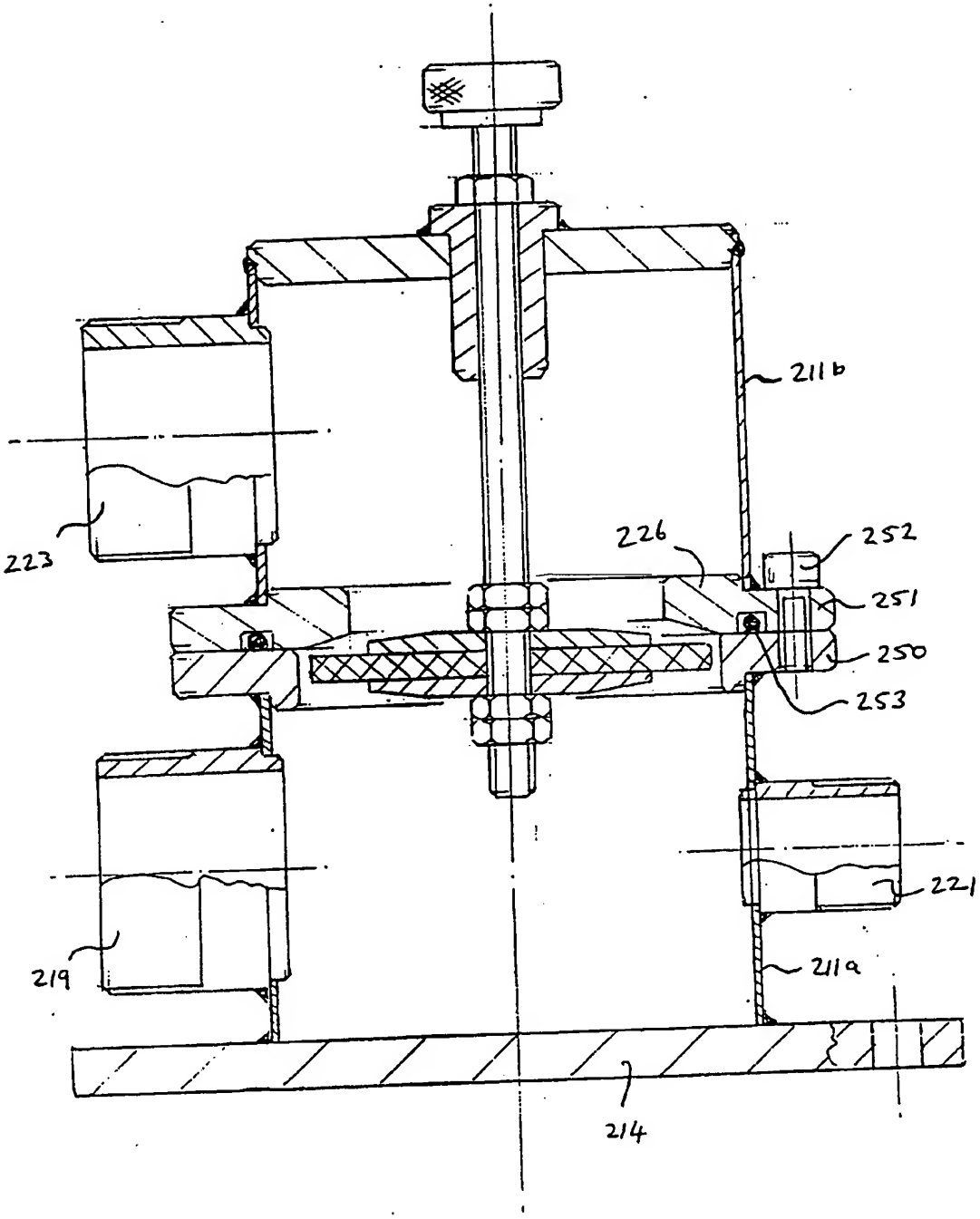

Fig 3

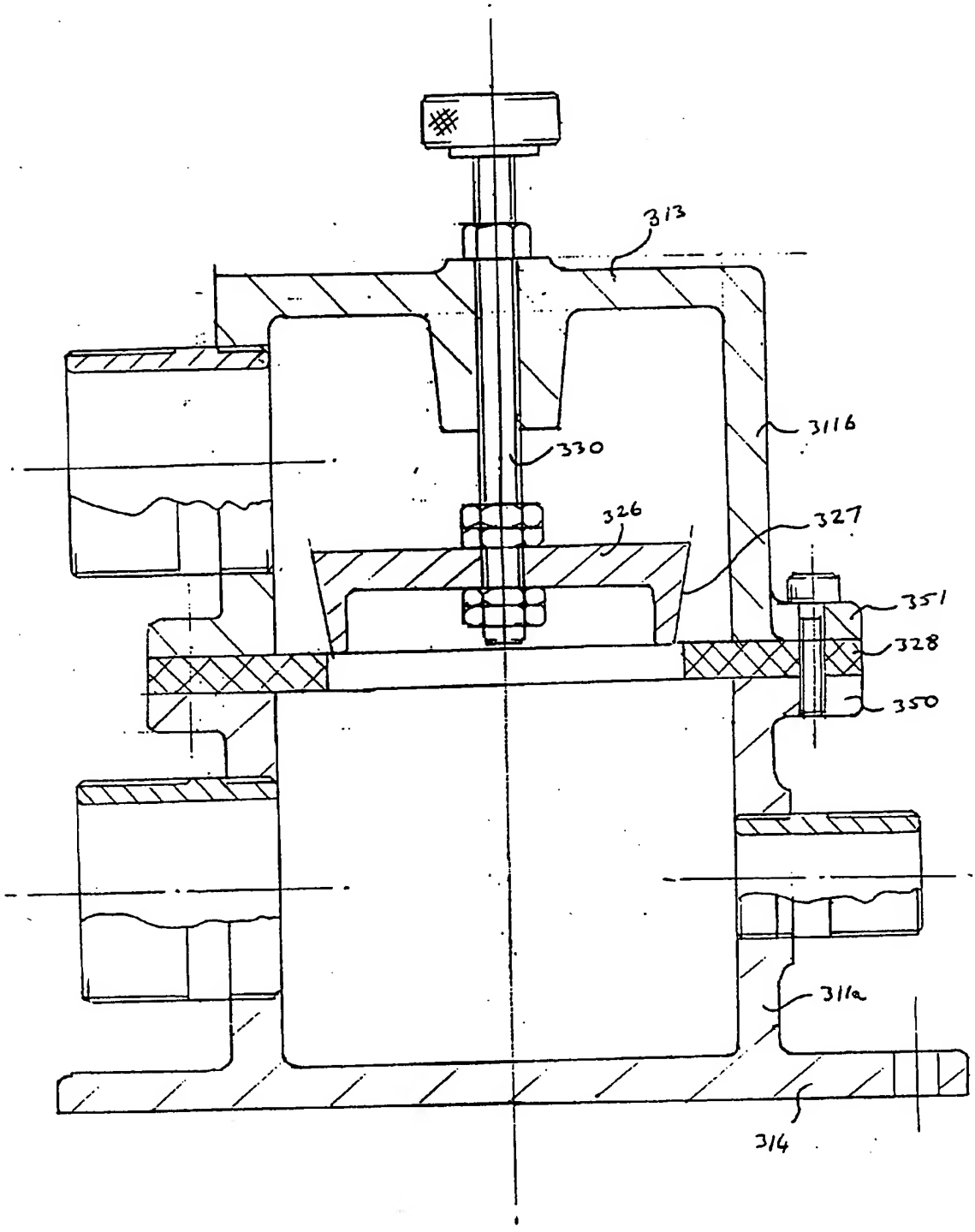

Fig 4

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PATENTS ACT 1977

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Title: HYDRAULIC RAM PUMP

Description of Invention

This invention relates to hydraulic ram pumps.

The principle of operation of the hydraulic ram pump has been known for many years. The pump has a body with an inlet port and a waste or outlet port, a supply pipe being connected to the inlet port to deliver water to the pump at a relatively small head but a substantial flow rate. A pulse valve which in its normal state allows water to flow from the inlet port and out through the outlet port is arranged to be snapped shut by such flow of water when a certain such flow is attained, and when this occurs the kinetic energy of the column of water upstream of the valve is converted into a pressure pulse. Usually the pulse valve has been provided in the outlet port. The pump further has a delivery port upstream of the pulse valve, such delivery port having a non-return or check valve associated therewith and leading to a delivery pipe which can extend to a height many times greater than the head of water which is supplied to the inlet of the pump, the pressure pulse when the pulse valve closes causing some water to be expelled past the check valve to the delivery pipe. The pulse valve then re-opens and the cycle of operations repeats itself. Thus the pump, as long as it has an adequate supply of water, can pump a proportion of such water to a substantial distance away from, or height above, its source of water supply.

As above referred to the principle of operation of the hydraulic ram pump has been known for many years, and the design of ram pumps has, on the whole, remained old fashioned. A typical ram pump is made out of cast iron and it is an extremely heavy and bulky item of equipment rendering installation

and maintenance difficult. Adjustment of the pulse valve is required to ensure that the pump works satisfactorily in accordance with the supply of water with which it is provided (head and available flow rate), and such adjustment is not easy. Thus while the pump is reliable and long lasting once it has been installed and set up to operate correctly, such installation and set up is not as easy as it might be.

It is broadly the object of the present invention to provide a ram pump which, as compared with those previously known, is relatively light and compact and easy to adjust and maintain.

According to one aspect of the present invention, we provide an hydraulic ram pump comprising a body defining an internal inlet chamber; a valve seating and a resilient valve member within said body between said inlet chamber and an outlet; said resilient valve member being able to be displaced into engagement with said valve seating by flow from said inlet chamber to said outlet thereby to stop said flow; adjustment means for adjusting the position of said valve member relative to said valve seating; and supply and delivery ports communicating with said inlet chamber.

Preferably the body further defines an internal outlet chamber with which an outlet port communicates.

The body of the pump conveniently is of generally cylindrical form, and the valve seating and valve member are disposed between the ends of the cylindrical body to define a boundary between said inlet and outlet chambers thereof.

The valve member may be in the form of a disc of a suitable wear resistant elastomeric material for example a natural or synthetic rubber material, e.g. "Neoprene", at least a peripheral portion of the valve member being able to displace into contact with the valve seating in response to said flow between said chambers to stop said flow. Alternatively the valve member

may be of annular form with an inner peripheral portion being able to displace into contact with the valve seating.

Preferably the ends of the cylindrical body are closed by end walls, and the valve member or valve seating is supported by a support member carried by one of said end walls and extending co-axially into the body. Preferably the support member, which may be in the form of a rod, has screw-threaded engagement with a carrier which in turn is supported by the appropriate end wall, adjustment of the position of the valve member being effected by rotating said rod about its axis, thereby causing it to be moved axially by virtue of the screw thread thereon.

At least one of the end walls of the body of the pump should be removable to provide for access to the interior of the pump body for any necessary replacement or maintenance of the valve member and/or valve seating. In the embodiment described hereafter such end wall is provided with the inlet port, facing the valve member.

The body of the pump conveniently is a fabrication, made by joining together by welding components of a suitable metal, e.g. stainless steel.

The invention will now be described by way of example with reference to the accompanying drawings, of which

Figure 1 is a side elevation partly in section above pump in accordance with the invention.

Figures 2, 3 and 4 are views as Figure 1 of further embodiments of pump in accordance with the invention.

Referring to the drawing, the illustrated pump comprises a body indicated generally at 10, having a cylindrical peripheral wall 11 to one end of which there is welded an annular flange 12 and to the other end of which there is welded an end wall 13. The flange 12 is abutted by an end wall member 14 held thereto by a plurality of circumferentially spaced bolts one of which bolts is indicated at 15, and an O-ring is received in an annular space 16 in the flange

12 and arranged to be compressed when the bolts as 15 are tightened so that the end wall member 14 is attached in a liquid-tight manner. To the cylindrical wall 11 of the body are welded two support brackets 17, 18 which provide for the pump to be supported on a suitable surface and made fast by suitable fastenings.

The end wall member 14 has a central inlet port fitting 19 welded thereto. The fitting 19 has an external screw-thread 20 for screw-threaded connection of an inlet pipe by way of a suitable union. Adjacent the flange 12 the wall 11 is provided with a laterally extending delivery port fitting 21 which is, like the inlet port fitting 19, screw-threaded (at 22) for engagement by way of a suitable union with a delivery pipe. Adjacent the end plate 13, the wall 11 is provided with an upwardly extending waste or outlet port fitting 23 which may be connected to a waste pipe, the size of the passage afforded by the fitting 19 being substantially the same size as that afforded by the fitting 23. In the drawing, the fittings 21, 23 are illustrated as being alongside one another but if they would, in this disposition, be too close to one another for easy connection of unions to both of them, the delivery port fitting 21 may be disposed where indicated at 24, i.e. as the pump is viewed end on, at 90° to the fitting 23 about the longitudinal axis 25 of the pump body.

In the interior of the pump body there is provided an annular valve seat member 26. This is welded to the interior of the wall 11, and has a valve seat surface 27 facing the inlet port fitting 19. A valve member 28 in the form of a disc of, preferably, a synthetic rubber material such as "Neoprene" is carried between two rigid support members 29 which have central apertures receiving a threaded part of a support rod 30. Lock nut assemblies 31 to either side of the members 29 hold the members 29 and the valve member 28 in a fixed position on the rod 30. An outer annular portion 28a of the valve member 28 is able to be displaced into engagement with the valve seat surface 27.

The support rod 30 extends through and has screw-threaded engagement with a carrier member 32 which itself has screw-threaded engagement with a central aperture in the end plate 13. An unthreaded part 33 of the rod 30 extends outwardly from the carrier member 32 through a sealing gland arrangement 34, the sealing material in the gland arrangement being compressed by a gland nut 35. The free end of the rod part 33 has an adjustment knob 36.

The pump as above described would be installed in a suitable position with an inlet pipe connected to the fitting 19, for supplying water to the pump from a source above the level of the pump. An outlet or waste pipe would be connected to the fitting 23, leading waste water from the pump to a suitable disposal point. A non-return or check valve would be connected to the fitting 21, providing for flow of water outwardly from the pump but preventing return of such water thereto. A delivery pipe leading to the required delivery point would be connected to the check valve, and desirably adjacent the pump such delivery pipe would be provided with an inverted U-bend and at the top point of such bend an air vessel for smoothing the flow pulses of water delivered through the delivery pipe. The check valve and air vessel may be standard off-the-shelf plumbing components: the air vessel may be of the type including an internal flexible diaphragm for separating the air and water spaces in the interior of the vessel from one another.

The arrangement of the valve member 28 and valve seat member 26 divides the interior of the pump body into inlet and outlet chamber parts 40, 41. In known manner for an hydraulic ram pump, water entering the inlet chamber 40 from the inlet pipe connected to the inlet port fitting 19 is able to flow past the pulse valve arrangement constituted by the valve member 28, 30 and seating 26, 27, to the outlet chamber 41 and the waste outlet 23, until such flow reaches a speed which causes the valve member part 28a to deflect into engagement with the valve seat surface 27 and block such flow. The kinetic

energy of the water in the inlet pipe and chamber 40 of the pump is converted into a pulse of pressure causing some of such water to be displaced out through the delivery port fitting 21 and the check valve connected thereto, into the delivery pipe. The pulse valve then re-opens after dissipation of the pressure pulse, the part 28a of the valve member 28 moving away from the seat surface 27 by virtue of the resilience of the valve member, and the flow of water through the outlet port 23 re-establishes itself until the cycle repeats.

The ability to adjust the position of the valve member 28 relative to the valve seat member 26, by turning the adjustment knob 36, enables the pump to be adjusted very easily to suit different installations which may vary in respect of the flow rate and head of water available to operate the pump. Such adjustment does not entail any dismantling of the pump. When such adjustment has been carried out, any undesired tendency for the adjustment to alter may be avoided by providing a locking means for the rod part 33 or knob 36, or the gland nut 35 may be tightened sufficiently to afford a high frictional resistance to rotation and thus axial movement of the rod 30, 33.

By virtue of the construction of the pump as a welded fabrication of components of a suitable corrosion-resistant material such as stainless steel, the pump is light in weight and compact compared with hydraulic ram pumps as generally known hitherto. Should access be required to the interior of the pump, if the valve member should require attention or replacement, this is easily achieved by removal of the end wall member 15. The valve member itself is a simple and thus inexpensive component, and if a correct replacement therefor is not available should it fail after long service, a replacement valve member which will enable the pump to function is easily made from typical materials which are widely available even in third world countries. If such a replacement valve member does not have the same stiffness characteristics as the original, the ability of the pulse valve arrangement easily to be adjusted enables the pump to be made operational under such conditions.

Whilst as above described the pump body defines an outlet chamber 41, it would be within the broadest scope of the invention for there to be no such chamber, i.e. for there to be only the inlet chamber, with the pulse valve arrangement 26-30 leading directly therefrom to the exterior of the pump body. In this case, if there were no end wall 13, the support rod 30 would be carried by a suitable bracket or the like on the body of the pump.

Referring now to Figure 2 of the drawings, this shows a pump which is similar in respect of the configuration of its body and valve arrangement to the pump of Figure 1. The following description will therefore be confined to the differences of this embodiment from the pump of Figure 1, and parts corresponding to those appearing in Figure 1 are identified by the same reference numerals with the addition of 100.

The pump of Figure 2 comprises a body with a cylindrical peripheral wall 111 which is intended to be installed in an upright orientation with the longitudinal axis 125 of the body extending substantially vertically. For installing the pump in such an orientation, the end wall 114 thereof extends radially outwardly beyond the periphery of the flange 112 and is provided with apertures as indicated at 114a for receiving suitable fixing fasteners. The pump has an inlet port 119, a delivery port 121 and an outlet port 123, and both the ports 119 and 121 are provided in the cylindrical wall 111.

Referring now to Figure 3 of the drawings, in which parts corresponding to those in Figure 1 are identified by the same reference numerals with the addition of 200, this pump is again intended to be installed in an upright orientation. Instead of a removable lower end wall 114, however, end wall 214 is permanently fixed to a lower part 211a of the cylindrical wall of the pump, and there is a separate upper part 211b of such cylindrical wall. The two parts 211a, 211b are welded to abutting flange parts 250, 251 respectively which are joined to one another by a plurality of circumferentially spaced bolts one of which is indicated at 252, the abutting flange parts being sealed by an O-ring

253. A radially inwardly extending valve seat portion 226 is integral with the flange 251. Inlet port 219, delivery port 221, and outlet port 223 are provided in the same positions as in the embodiment of Figure 2.

Referring finally now to Figure 4 of the drawings, this shows a further embodiment of pump, the configuration of whose body is somewhat similar to that of Figure 3. In this embodiment, however, the body comprises a lower cylindrical part 311a with an integral lower end wall 314 for mounting the pump, and an upper cylindrical body part 311b integral with an upper end wall 313. The body parts 311a and 311b are joined to one another at facing flange parts 350, 351 which are bolted together with an annular valve member 328 held therebetween. An inner peripheral portion 328a of the valve member projects radially inwardly into the interior of the body. A valve seat member 326 with a frusto-conical seat surface 327 is carried by a support member 330 which is adjustably carried by the end wall 313 in an analogous manner to the adjustability of the support member carrying the valve member in the embodiments of Figures 1, 2 and 3.

Despite its different arrangement of valve member and valve seating, the mode of operation of the embodiment of pump shown in Figure 4 is the same as that of the previous embodiment.

It will be appreciated that further modifications in the construction of the pump may be made without departing from the scope of the present invention. For example, the adjustment of the position of the valve member relative to the valve seat member may be effected by a power driven (e.g. electrically, hydraulically or pneumatically) device which may be remotely controlled. This may be desirable if the pump is installed in a relatively inaccessible position. It is referred to that the delivery port may be disposed in any convenient position relative to the inlet chamber of the pump; a further possibility for such disposition is that the delivery port could communicate with the inlet chamber by being disposed in a supply pipe close to the pump rather than being

connected to the pump body itself. In this case, the construction of the pump body could be further simplified.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. An hydraulic ram pump comprising a body defining an internal inlet chamber; a valve seating and a resilient valve member within said body between said inlet chamber and an outlet; said resilient valve member being able to be displaced into engagement with said valve seating by flow from said inlet chamber to said outlet thereby to stop said flow; adjustment means for adjusting the position of said valve member relative to said valve seating; and supply and delivery ports communicating with said inlet chamber.

2. A pump according to Claim 1 wherein said body defines an internal outlet chamber with which an outlet port communicates.

3. A pump according to Claim 2 wherein said valve seating and valve member are disposed between end parts of the pump body to define a boundary between said inlet and outlet chambers thereof.

4. A pump according to any one of the preceding claims wherein the body thereof is of cylindrical form.

5. A pump according to Claim 4 wherein the ends of the cylindrical body are closed by end walls.

6. A pump according to Claim 5 wherein one of said valve member and valve seating is supported by a support member carried by one of said end walls and extending co-axially into the body, while the other of said valve member and valve seating is supported by the cylindrical body.

7. A pump according to Claim 6 wherein the support member has screw-threaded engagement with a carrier supported by said one end wall, adjustment of the position of the valve member or valve seating being effected by rotating the support member about its axis.

8. A pump according to Claim 7 wherein the support member has a knob or the like disposed externally of the pump body for effecting said rotation thereof.

9. A pump according to any one of Claims 6 to 8 wherein said valve seating is of annular form and said valve member is supported by said support member and comprises a disc of elastomeric material, at least an outer peripheral portion thereof being able to displace into contact with the valve seating in response to said flow between said chambers, to stop said flow.

10. A pump according to any one of Claims 6 to 8 wherein said valve seating is supported by said support member and said valve member is of elastomeric material of annular form supported by said cylindrical body and comprising an inner peripheral portion to displace into contact with the valve seating in response to said flow between the chambers, to stop said flow.

11. A pump according to any one of Claims 5 to 10 wherein one of said end walls is removable, to provide access to the interior of the body.

12. A pump according to Claim 11 wherein said removable end wall has said inlet port, facing the valve member.

13. A pump according to any one of the preceding claims wherein said delivery and outlet ports extend laterally from the pump body.

14. A pump according to any one of the preceding claims which is a fabrication of components welded to one another.

15. A pump according to Claim 14 wherein at least some of said components are of stainless steel.

16. A pump substantially as hereinbefore described with reference to the accompanying drawing.

17. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

The Patent Office

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Application No: GB 9725108.6
Claims searched: 1-16

Examiner: James Barnes-Paddock
Date of search: 2 August 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F1R (R6)

Int Cl (Ed.6): F04F 7/00, 02

Other: Online: WPI, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 0 391 289	(BLAKE) See Figs. 1, 3. Hydraulic ram with lift controled rubber valve.	1
X	GB 0 276 485	(GREEN) See Fig. 3. A hydraulic ram rubber waste valve member in cradle adjustable relative to valve seat.	1-3
X	WO 97/37136 A1	(SELWYN) See Fig. 3. A screw adjustable resilient valve member.	1-3
X	US 4 537 563	(KATSUHIKO) See Figs. 2, 4. Ram pump with adjustable resilient release valve.	1-3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.